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Original Article

The Potential of Kalelo Yogurt as Supplementary Foods to Prevent Stunting

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ABSTRACT

This study aims to determine the potential of kalelo yogurt as supplementary feeding to prevent stunting. This type of research was pre-experimental with the Post-test only design method with the yogurt formula treatment. The statistical analysis used was Complete Randomized Design (CRD) 3 X 2 followed by Duncan test to see the difference in each formulation. And the organoleptic test of kalelo yogurt was processed using the Analysis Of Variant (ANOVA) test and Duncan test to see the level of difference significant at α level of 0.05. Results: The best formula of kalelo yogurt based on nutrient content was F1, which was consumed simultaneously with other foods to increase its nutritional value. While organoleptic tests showed F3 as the best product, with a rating level of (somewhat dislike-neutral). Based on the test results, the panelists still did not like kalelo yogurt very much, as it can be seen from the results of panelist evaluations ranging from somewhat dislike to neutral (4-5). This could be due to the aroma, taste and texture that were different from a solid yogurt. With increasing incubation time, microbial activity increases and the number of microbes increases, resulting in the pH of the medium decreasing. The best kalelo yogurt product from organoleptic and nutrient content was F3 and F1, respectively. The nutritional, energy and micronutrient content of the three formulas were not significantly different. To fulfill the nutritional needs of sufficient numbers requirements, pregnant women are advised to consume several times a day accompanied by other foods.

Keywords: *PMT (supplementary feeding), Yogurt, Pregnant Women, Breastfeeding Mother, Jackfruit Seeds (Arthocarphus heterophilus), Soybeans (Glycine max L. Mer), Daun kelor (Moringa oleifera).*

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INTRODUCTION

Stunting is a condition that is caused by lack of nutritional intake and not in accordance with the needs in a long time, causing chronic malnutrition. Malnutrition at an early age increases infant and child mortality, causing sufferers to easily get sick and have a posture that is not optimal when they are adults. Mothers were advised to increase food intake during pregnancy, by paying attention to the food consumed such as enriching the diversity of nutrients which can improve the outcomes of mothers and babies [1,2,3-10,11]. In addition, in the process after pregnancy, namely the breastfeeding stage, Exclusive breastfeeding (EBF) is critical to a newborn's survival, development, and growth [12–16].

Indonesia is one of the developing countries that still faces the problem of stunting. Based on the results of the Indonesian Nutritional Status Survey 2022, 35% of Indonesian toddlers were in the short category, with the highest percentage in the provinces of West Sulawesi [17]. The government seeks to improve nutritional status to prevent stunting through various activities under the Provision of

Supplementary Foods for Pregnant Women, by meeting the needs through additional food or drinks that are high in macronutrients and micronutrients. Material selection for the supplementary food should be based on community interest. Food that will be processed into additional food for pregnant women should be the same as the food habits of pregnant women every day.

Indonesia is rich in micronutrient sources that are still not maximally processed. Local foods that can be developed into Supplementary Feeding products include jackfruit seeds (Arthocarphus heterophilus), soybeans (Glycine max L. Mer), and Moringa oleifera leaves. These indigenous ingredients offer significant potential for enhancing nutritional intake and addressing dietary deficiencies in various communities. Given the critical role of nutrition in preventing stunting among children, it's essential to explore innovative ways to incorporate these nutrient-rich foods into daily diets. One such approach is through the production of yogurt, which can serve as an accessible and nutritious option for young children. By harnessing the benefits of yogurt fortified with ingredients like jackfruit seeds, soybeans, and Moringa oleifera leaves, communities can proactively combat stunting and promote healthy growth and development among children. Soybeans have a high protein content which can be processed into various types of processed products, one of which is soy milk. In 100g of soybeans, it contains energy of 286 kcal, protein 30.2g, fat 15.6g and carbohydrates 30.1g [18]. Soy milk is currently being used as an alternative substitute for cow's milk. In addition to containing calcium, soybeans also contain phytoestrogens which are almost the same as estrogen which serves to help absorption of calcium in the blood although when substituting fortified soy-based alternatives, the nutrients already added to commercially available goods can effectively make up for the lack of milk and dairy products[19]. Jackfruit seeds are beneficial for growth and provide other benefits for humans [20–22]. Soybeans [23], moringa oleifera [24–28] and yoghurt [24] is believed to be effective in preventing stunting.

Moringa is known throughout the world as a nutritious plant and WHO has introduced moringa as an alternative food to overcome malnutrition. Herbal medicine has employed moringa oleifera for it is anti-bacterial, anti-inflammatory, antioxidant, anticancer, and antidiabetic properties [29]. Protein and minerals are found in moringa oleifera leaves. All parts of the moringa plant have nutritional value, efficacious for health and benefits in the industrial sector. The high nutritional value, efficacy and benefits caused the moringa to be nicknamed as the Mother's Best. Moringa leaves are rich in amino acids, minerals and antioxidant content.

The micronutrients content of moringa is 7 times vitamin C of orange, 4 times vitamin A of carrots, equal to 4 glasses of calcium from milk, 3 times potassium of bananas, and equal to protein content in 2 servings of yoghurts. Therefore, moringa has the potential as a probiotic drink for health drinks, or added to its nutritional food while iron-containing moringa leaves can be used as an alternate food source to address the issue of malnutrition [30].

Based on the information above, researchers felt that further research was needed to see the potential of local food ingredients to be processed into beverage formulas with the purpose of determining the potential of kalelo yogurt as supplementary foods to prevent stunting.

METHOD

This was a pre-experimental research with the Posttest only design method. The treatment used in this study was yogurt formula. The resulting yogurt will be seen as having an effect on the nutritional content of carbohydrates, proteins, fats and minerals Calcium (Ca) and Phosphorus (P) and organoleptic levels. The design of the main raw material formulations for instant functional drinks is as shown in Table 1.

Table 1. Yogurt formulas in 100% kalelo

Ingredients	**Formula**		
	F1	**F2**	**F3**
Sari Soybean (1:6)	40	35	50
Sari Jackfruit (1:6)	40	50	35
Moringa extract	20	15	15
Skim Milk	10	10	10
Sugar	10	10	10
Stater	10	10	10

The level of preference / organoleptic test was carried out by 30 panelists. Laboratory test results on nutrition were tested statistically

using a Completely Randomized Design (CRD) 3 X 2 followed by Duncan test to see the difference in mineral content of each formulation significantly at the level of α 0.05. Data on the level of preference / organoleptic results from instant functional drinks were processed statistically using the Analysis of Variant (ANOVA) test and continued with the Duncan test to see the different levels of organoleptic tests from each formulation significantly at the α level of 0.05.

RESULTS

Table 2. Average carbohydrate, protein, fat, calcium, phosphorus content in three types of kalelo yogurt formulas

Nutritional content	F1	F2	F3
Carbohydrate (%)	6.91[a]	5.685[b]	5.265[c]
Protein (%)	3.85[a]	3.65[a]	2.68[b]
Fat (%)	2.095[a]	2.08[a]	2.08[a]
Calcium (mg/kg)	269.91[a]	262.72[a]	267.44[a]
Phosphorus (%)	0.0885[a]	0.083[b]	0.0885[a]

Footnote description:

Carbohydrate (F1=a, F2=b, F3=c)
Protein (F1=a, F2=a, F3=b)
Fat (F1=a, F2=a, F3=b)
Calsium (F1=a, F2=a, F3=b)
Phosporus (F1=a, F2=b, F3=a)

Table 3. The average level of preference of panelists (flavour, taste, texture and acidity) of three types of kalelo yogurt formulas

	F1	F2	F3
Flavour	3.61[a]	4.48[a]	5.26[b]
Taste	4.13[a]	4.77[a]	4.68[a]
Texture	5.29[a]	5.29[a]	5.55[a]
Acidity level	3.90[a]	4.68[a]	4.77[a]

Footnote description:

Average level of preference of panelists (flavour, taste, texture and acidity)
F1=a, F2=a, F3=c

Table 4. The total energy of three kalelo yogurt formulas in 100 ml / serving

For mula	Energy sources	Content (%)	Energy (kcal/g)
F1	Carbohydrate	6.91	27.64
	Protein	3.85	15.4
	Fat	2.095	18.855
Total Energy			61.895
F2	Carbohydrate	5.685	22.74
	Protein	3.65	14.6
	Fat	2.08	18.72
Total Energy			56.06
F3	Carbohydrate	5,265	21.06
	Protein	2,68	10.72
	Fat	0,09	0.81
Total Energy			32.59

Table 5. Percentage of nutrition adequacy standard of the kalelo yogurt formula based on the snack needs of pregnant women

For mula	Energy sources	Product Content	Nutrition adequacy standard number first trimester pregnant women (19-29th)	30% Nutrition adequacy standard number first trimester pregnant women(19-29th)
F1	Energy	61.895 kcal	2430 kcal	729
	Carbohydrate	6.91 g	334 g	100.2
	Protein	3.85	76 g	22.6
	Fat	2.095	81 g	24.3
	Calsium	26.991	1300 mg	390
	Phosphorus	0.0885 g	0 mg	0
F2	Energy	56.06 kcal	2430 kcal	729
	Carbohydrate	5.685 g	334 g	100.2
	Protein	3.65 g	76 g	22.6 g
	Fat	2.08 g	81 g	24.3
	Calsium	26.272 mg	1300 mg	390
	Phosphorus	0.083 g	0 mg	0
F3	Energy	32.59 kcal	2430 kcal	729
	Carbohydrate	5.265 g	334 g	100.2
	Protein	2.68 g	76 g	22.6
	Fat	0.09 g	81 g	24.3
	Calsium	26.744 mg	1300 mg	390
	Phosphorus	0.0885 g	0 mg	0

DISCUSSION

Based on the data obtained it is known that in terms of the nutritional content of Formula 1 (F1) is the best formula because it has the highest nutrient content compared to Formula 2 (F2) and Formula 3 (F3). This could be due to the composition of the F1 formula which was greater than the other 2 formulas.

Based on the test results, the kalelo yogurt formulas were not well-received by the panelists, as seen from the results of panelist evaluations ranging from somewhat dislike-neutral [4-5]. This could be due to the aroma, taste, texture that were not similar to normal yogurt which is usually much denser. The texture of kalelo yogurt was not dense but thick, which could be attributed by the bioactive compounds found in moringa which accelerated yogurt fermentation by promoting growth of lactic acid

bacteria [39]. Besides, the aroma and taste of the yogurt may be different due to a mixture of jackfruit seeds, soybeans, and moringa that give different flavor and aroma from pure milk yogurt, which may not be familiar among the panelist. However, a study conducted in South Korea showed that moringa extract-supplemented yogurt was well received and exerted positive health benefit [39].

Lactic acid is produced from the lactose fermentation process by lactic acid bacteria which gives a distinctive sour taste to yogurt. Additionally, the majority of yogurt's texture depends on the type of bacteria that makes it and its content. Yogurt combines the health benefits of raw materials with the beneficial effects of its culture starter and numerous other active bacterias. The bacteria in this yogurt must remain active throughout the fermentation process to effectively break down the sugars present in the milk. This breakdown process not only contributes to the texture and taste of the yogurt but also enhances its nutritional value by increasing the availability of beneficial nutrients and probiotics. Therefore, ensuring the continued activity of these bacteria is essential for producing high-quality yogurt with optimal flavor and health benefits [31–37]. With increasing incubation time, microbial activity increases and the number of microbes increases, resulting in the pH of the medium decreasing. This proves the occurrence of chemical changes in the sugar component into an acid component.

The use of yogurt as to Supplementary Foods or Supplementary Feeding Product to prevent stunting is calculated as an additional menu (snack) for pregnant women so that it is expected to meet the needs of 30% daily RDA of pregnant women. Analysis of RDA percentage of kalelo yogurt showed that the taste of kalelo yogurt is influenced by the amount of acid produced during the fermentation process. The longer the fermentation process will produce more acid. The lactic acid was produced from the fermentation process through the breakdown of sugar, so that the higher acidity level, the sweetness of the product will decrease. The 48-hour fermentation produced high enough lactic acid content so that the sour taste was more dominant than the sweetness which caused the panelists to be somewhat not favoring the product.

The texture of kalelo yogurt was not too creamy, but thick. This was influenced by the composition of the ingredients used and the amount of skim milk added. Addition of Moringa leaf extract, jackfruit seed juice and soybean juice and incubation time affected the viscosity of the yogurt. The degree of acidity of milk decreases causing milk protein, namely casein, to coagulate. The best formula that approached the needs of 30% of daily RDA of pregnant women was F1 formula. However, since it still not reaching the target of 30% daily RDA of pregnant women, other sources of nutrition will still need to be added. Based on regulation of the Minister of Health of the Republic of Indonesia number 28 of 2019, trimester 1 pregnant women in the age range of 19-29 years will require additional energy of 180 kcal from 2250 kcal, additional protein of 1g of 60g, total fat of 2.3g of 65g, and additional carbohydrates of 25g from 360g, 200mg calcium from 1000 mg and. To meet these additional needs, it is recommended for pregnant mothers to consume kalelo yogurt as a daily snack together with other foods.

One practical recommendation to implement the findings in dietary interventions is to develop educational programs targeting pregnant and breastfeeding mothers. These programs can focus on promoting the consumption of kalelo yogurt as a nutritious snack option. Additionally, healthcare providers can offer personalized dietary counseling sessions to pregnant women, emphasizing the importance of incorporating kalelo yogurt into their daily diet to meet their nutritional needs. Furthermore, collaborations with local community organizations can be established to distribute kalelo yogurt samples and organize cooking demonstrations to encourage its consumption. By integrating these strategies, stakeholders can effectively promote the adoption of kalelo yogurt as a dietary intervention to prevent stunting among vulnerable populations.

CONCLUSION

The best formula which contains the highest amount of nutrient content is Formula F1, with the nutrient content, energy and micronutrients of the three formulas not too different. The best preference of kalelo yogurt product is F3 formula with ratings ranging from 4-5 (somewhat non-neutral). It was concluded that the acid produced was too high which affects the final results of the organoleptic test.

The suggestion is to address the identified shortcomings in the research design, proposed measures include the implementation of stricter designs, such as randomized controlled trials (RCTs), as well as an improvement in sample size and more adequate representation. Consequently, future research can yield results that are more trustworthy and relevant to informing sustainable policy and clinical practices.

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